REMARKS

Claims 21-28 are pending in the present application. Claims 21, 25, 27 and 28 have been amended, claims 22 and 23 have been cancelled, and claims 41-49 have been added, leaving claims 21, 24-28 and 41-49 for consideration upon entry of the present Amendment. The Specification has been amended to update the status of U.S. Application Nos. 09/019061 and 08/558,133 as requested by the Examiner. No new matter has been introduced by these amendments. Reconsideration and allowance of the claims is respectfully requested in view of the above amendments and the following remarks.

1. Claim Rejections Under 35 U.S.C. § 102

Claims 21-27 stand rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 5,716,422 to Muffoletto et al. Muffoletto discloses an electrochemical cell having a cathode comprising a substrate and a cathode active material provided by as a thermal spray deposited layer with a thickness of about 0.001 inches (25.4 microns) to about 0.4 inches (10,000 microns). The active material is selected from the group consisting of silver vanadium oxide, copper silver vanadium oxide, manganese dioxide, titanium disulfide, copper oxide, chromium oxide, copper sulfide, iron sulfide, iron disulfide, cobalt oxide, nickel oxide, carbon and fluorinated carbon and mixtures thereof.

In contrast the claimed invention is directed to an electrode for an energy storage and conversion device, comprising a substrate and a layer of an active material having a thickness in the range from about 5 to about 114 microns deposited on the substrate. The active material comprises a metal sulfide, metal selenide, or metal telluride that decomposes or transforms at thermal spray temperatures to a material unsuitable for use in an electrode. The

claimed active materials are not available using the conventional thermal spray techniques disclosed in Muffoletto because they decompose or transform to materials unsuitable for use in electrodes. As taught in the instant specification beginning at page 8, line 8 conventional plasma spray of FeS_2 (pyrite) results not in the deposition of FeS_2 but in the deposition of Fe_7S_8 (troilite), which is not suitable for use in an electrode.

To anticipate a claim under 35 U.S.C. § 102, a single source must contain all of the elements of the claim. *Lewmar Marine Inc. v. Barient, Inc.*, 827 F.2d 744, 747, 3 U.S.P.Q.2d 1766, 1768 (Fed. Cir. 1987), *cert. denied*, 484 U.S. 1007 (1988). While Muffoletto does disclose electrodes comprising active material deposited by thermal spray, Muffoletto does not anticipate the claimed invention because Muffoletto does not contain the element of a metal sulfide, metal selenide, or metal telluride that decomposes or transforms at thermal spray temperatures to a material unsuitable for use in an electrode. Muffoletto, in contrast to the instant specification, teaches no method that would prevent the decomposition or transformation materials like pyrite during thermal spray. Accordingly, Applicants request reconsideration and withdrawal of the rejection of Claims 21-27.

Claims 21-27 stand rejected under 35 U.S.C. § 102(e) as being anticipated by U.S. Patent No. 6,210,832 to Visco et al. Visco discloses a redox electrode for a battery cell that has a coating to mitigate plugging of the electrode by precipitated discharge products. The coating comprises a mixed ionic electronic conductor (MIEC) that is applied to the electronic conductor component of the redox electrode. The MIEC allows rapid removal of the precipitated discharge products but does not function as the active material of the electrode. Besides the electronic conductor component coated with the mixed ionic electronic conductor, the redox electrode also includes an electrochemically active material and an

ionically conductive material. (Col. 3, lines 26-40) The MIEC coating may comprise TiS_2, FeS_2 and is typically deposited using chemical vapor deposition. Visco states at Col. 5, line nos. 48-50 that the thickness of the MIEC coating may be from about 1000 Å (0.1 microns) to 5 microns. Visco is silent with regard to the thickness of the electrochemically active material and therefore does not teach a layer of active material on a substrate having a thickness in the range from about 5 to about 114 microns as seen in the instant claims.

Claims 21 and 24-28 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 3,907,589 to Gay et al. Gay et al. discloses a cathode composition comprising a transition metal sulfide such as FeS_2, a particulate current collector, electrolyte, and a sulfide product of the cell reaction in excess of that produced by the discharge of the cell. (Abstract). Gay discloses forming the cathode by blending the cathode constituents to form a flocculent mass at the operating temperature. (Example 1) Gay contains no disclosure with regard to the thickness of the cathode composition. Because Gay does not contain all the elements of the claimed invention, namely active material with a thickness from about 5 to about 114 microns, Gay cannot provide a proper basis for a rejection under 35 U.S.C. §102(b).

Claims 21 and 24-28 stand rejected under 35 U.S.C. § 102(b) as being anticipated by U.S. Patent No. 4,013,818 to Askew et al. Askew discloses a high temperature secondary battery comprising a stack of cells. Each cell has a pellet of immobilized electrolyte sandwiched between a negative electrode pellet and a positive electrode pellet. The positive electrode pellet is composed at least partially of a metal sulfide. The electrode pellets have a thickness of 1 mm (Col. 2, lines 67-68) and as such cannot anticipate the claimed invention

in which the active material has a thickness of about 5 to about 114 microns. Applicants respectfully request reconsideration and withdrawal of the rejection.

2. Claim Rejections Under 35 U.S.C. § 103

Claims 21 and 28 are rejected under 35 U.S.C. §103(a) as being obvious over Muffoletto or Visco, each taken in view of Gay. In particular, the Examiner has indicated that it would have obvious to use materials having the small particle size of Gay in the teachings of Muffoletto or Visco in order to produce greater power output.

As discussed above, Muffoletto discloses the production of electrodes by thermal spray. Muffoletto teaches the use of metal sulfides in thermal spray as does the claimed invention. There is however, a significant difference. Muffoletto teaches the use of active materials obtained by conventional thermal spray. The instant claims employ active materials which decompose or transform at thermal spray temperatures. Muffoletto does not teach or suggest the use of active materials that decompose or transform at thermal spray temperatures. Gay has been cited for its teaching regarding nanosized particles.

For an obviousness rejection to be proper, the Examiner must meet the burden of establishing a prima facie case of obviousness. *In re Fine*, 5 U.S.P.Q.2d 1596, 1598 (Fed. Cir. 1988). Establishing a prima facie case of obviousness requires that all elements of the invention be disclosed in the prior art. *In Re Wilson*, 165 U.S.P.Q. 494, 496 (C.C.P.A. 1970). Applicants assert that the combination of Muffoletto and Gay does provide all the elements of the invention. Muffoletto does not disclose the use of active materials that decompose or transform at thermal spray temperatures in an electrode. Gay does not overcome this deficiency. Thus the claimed invention is unobvious.

As discussed above, Visco discloses a redox electrode comprising an electrochemically active material, an electronically conductive material with an MIEC coating, and an ionically conductive material. The MIEC coating may comprise a metal sulfide and has a thickness of 0.1 to 5 microns. Visco does not teach an electrode comprising a substrate and a layer of active material comprising a metal sulfide, metal selenide or metal telluride having a thickness of in the range from about 5 to about 114 microns. Similar to above, Gay has been cited for its teaching regarding nanosized particles and does not overcome these deficiencies. As a result, the claimed invention is unobvious.

It is believed that the foregoing amendments and remarks fully comply with the Office Action and that the claims herein should now be allowable to Applicants. Accordingly, reconsideration and allowance is requested.

If there are any additional charges with respect to this Amendment or otherwise, please charge them to Deposit Account No. 06-1130 maintained by Applicants' attorneys.

Respectfully submitted,

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IN THE SPECIFICATION

A marked up version of the paragraph beginning at the bottom of page 11 follows:

The active material feedstock may comprise a microstructured or nanostructured material, which after thermal spray results in electrodes with microstructured or nanostructured active material. As used herein "microstructructed" materials refers to materials having a grain size on the order of about 0.1 to about 500 micrometers (microns) and "nanostructured" materials refers to materials having a grain size on the order of 1 to 100 nanometers (where 1 nm = 10 angstroms). Nanostructured materials are thus characterized by having a high fraction of the materials' atoms residing at grain or particle boundaries. For example, with a grain size in the five nanometer range, about one-half of the atoms in a nanocrystalline or a nanophase solid reside at grain or particle interfaces. Rapid interaction between the active materials and its surroundings are possible because of high surface area of the nanostructured materials. Therefore, the materials could sustain high current charging and discharging conditions. Thermal spray of nanostructured feedstocks to produce nanostructured coatings is disclosed in ~~allowed U.S. patent~~ application Serial No. 09/~~019061~~, U.S. Patent No. 6,025,034, filed February 5, 1998, entitled "Nanostructured Feeds for Thermal Spray Systems, Method of Manufacture, and Coatings Formed Therefrom," which is a continuation of U.S. patent application Serial No. 08/558,133 filed November 13, 1995, now abandoned, which is incorporated herein by reference.

IN THE CLAIMS

A marked up version of claims 21, 25, 27, and 28 follows:

21. An electrode for an energy storage and conversion device, comprising

a substrate; and

a layer of an active material comprising a metal sulfide, metal selenide, or metal telluride, and having a thickness in the range from about ~~1~~ 5 to about ~~4000~~ 114 microns deposited on the substrate, wherein the active material decomposes or transforms at thermal spray temperatures to a material unsuitable for use in an electrode ~~at thermal spray temperatures~~.

25. The ~~method~~ electrode of claim 21, wherein the active material is FeS_2, CoS_2, WS_2, NiS_2, or MoS_2.

27. The ~~method~~ electrode of claim 21, wherein the active material is microstructured.

28. The ~~method~~electrode of claim 21, wherein the active material is nanostructured.